INTERNATIONAL TSUNAMI INFORMATION CENTER

NEWSLETTER

P.O. Box 3830, Honolulu, Hawaii 96812

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISION
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The ITIC Newsletter bring news and information to tsunami researchers, engineers, educators, community protection agencies and governments in 45 countries. We welcome your news, reports, papers, or abstracts.

Opening of the Sixth Session of the IOC's International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). From left to right: Dr. Melecio S. Magno, Chairman, National Development Board of the Philippines; Mr. Gerry Dohler, Chairman ICG/ITSU; Dr. Roman L. Kintanar, Director-General, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA); and Dr. Gunter Giermann, Deputy Secretary, IOC.

SIXTH SESSION OF IOC'S INTERNATIONAL CO-ORDINATION GROUP FOR THE TSUNAMI WARNING SYSTEM IN THE PACIFIC (ICG/ITSU), MANILA, PHILIPPINES, FEBRUARY 20-25, 1978

Summary Report

1. *Opening of the session*

The sixth session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) was convened at the Silahis International Hotel in Manila, Philippines, on Monday, 20 February 1978, at 10:00 a.m. The Unesco National Commission of the Philippines, in co-operation with the National Science Development Board, acted as the host for this meeting, and made arrangements for logistical support.

The session was opened by the Chairman of the Group, Mr. G. Dohler, who welcomed the participants and introduced the speakers.

The inaugural ceremony began with a welcoming address by Dr. Roman L. Kintanar, Director-General, Philippine Atmospheric, Geophysical and Astronomical Services Administration, followed by an address of the guest of honour, Dr. Melecio S. Magno, Chairman, National Science Development Board.

Dr. G. Giermann, Deputy Secretary of the Intergovernmental Oceanographic Commission of Unesco, then welcomed the Group in the name of the Director-General of Unesco and the Secretary of IOC, and thanked the government of the Philippines for hosting the meeting and providing such fine facilities.

Mr. Dohler closed the inaugural session in giving his report on the activities between the 5th and 6th session and thanking the government of the Philippines for its hospitality in the name of the Group.

2. *Adoption of the agenda and election of a rapporteur*

The Group adopted the provisional agenda without changes. Dr. G. Pararas-Carayannis, Director of ITIC, was elected rapporteur.

3. *State of implementation of resolution EC-VII.13 and of recommendations 3 to 13, from the 5th session of the ICG/ITSU (Lima, Peru, 23-27 February 1976)*

The Secretary, Director of ITIC and Member States reported on the state of implementation of the above-mentioned resolution and recommendations. It was felt that the progress made in the implementation of these recommendations was not always satisfactory, and that in future recommendations should be accompanied by more specific action items.

4. *Decision of the IOC Assembly at its 10th session, on a new mandate for ITIC (IOC res. X-23)*

The Secretary reported that the new mandate and functions for ITIC were adopted by the IOC Assembly during its 10th session in October-November 1977.

Concerning the status of the Director and the Associate Director of ITIC, the Director informed the Group that he is now working full-time for the Centre. The Group expressed its concern that funds for the new Associate Director, Mr. Ridgway, were only available for a 9 to maximal 12 months period. The Chairman suggested that countries make contributions to the IOC Trust Fund for this post and asked the representatives of the Member States to express to their appropriate offices the urgency of support.

5. *Activity report by the Director, ITIC*

The Director of ITIC presented a comprehensive report on the activities of his Centre which was welcomed by the Group. The report also contains proposals for further development including a Draft of a Programme Development Plan which was taken into consideration by the Group in formulating recommendations on budget and programme priorities. Future activity reports should be submitted to the Member States two months prior to the ITSU meetings.

6. *National activity reports*

The representatives of the Member States reported on developments in their respective countries. Written reports were presented by the representatives from Canada, Chile, Ecuador, Fiji, Indonesia, Japan, Philippines, Thailand, USA, and USSR. The Secretary read New Zealand's activity report. These reports are not annexed to the Summary Report, but will be made available, on request, by the Secretary of IOC, Paris or the Director of ITIC, Honolulu.

7. *Consideration of recommendations from the IUGG Tsunami Committee meeting held in Ensenada, Mexico, 23-26 March 1977*

The Group regretted that the Chairman of the IUGG Tsunami Committee, Professor S.L. Soloviev, was not able to attend the meeting. On his behalf, the Director of ITIC introduced the above-mentioned recommendations. The Group noted the Committee recommendations and asked the Director of ITIC to take into consideration the first recommendation of the Committee in preparing a Guide for Tsunami Damage and Survey Procedures, to be completed by August 1978. Member States should submit ideas on the subject prior to 1 June 1978.

8. *Proposals for further expansion of the Tsunami Warning System in the Pacific*

The Director of ITIC presented to the Group proposals for future expansion of the Tsunami Warning System. Proposals included the addition of tidal and seismic sensors and communications to the System in Member States of ICG/ITSU presently not actively involved in the System, as well as the addition of stations in countries which may be joining the Group at some future time.

The Group considered these proposals, and particularly the need for regional tsunami warning systems, as expressed specifically by the delegate of Ecuador and the observers of Fiji and Indonesia. The Group agreed that the Director of ITIC and interested Member States should examine the feasibility of establishing such regional tsunami warning systems, should co-ordinate their efforts with the Office of the United Nations Disaster Relief Co-ordinator

(UNDRO) and the United Nations Development Programme (UNDP), and should explore the possibility of international funding for that purpose.

At the suggestion of the Chairman, an ad hoc group was organized which subsequently formulated recommendations on budget and programme priorities for 1981/1982. Recommendation ITSU-VI.1 was adopted.

9. *Proposals for further technical improvements of the Tsunami Warning System in the Pacific (TWS)*

The Director of ITIC summarized the progress made to date and presented plans for further technical improvements for the Tsunami Warning System. The Chairman established an ad hoc group on technical improvements which developed the following action plan which was adopted by the Group:

The Group requests Canada and the USA to investigate the use of satellites in the TWS and to prepare a report for publication in the ITIC newsletter by 1 January 1979. The USSR and Japan are requested to provide information on their satellite programmes by 1 June 1978 for inclusion in this report.

The Group requests each Member State to review the communication facilities between its TWS gauges and the Pacific Tsunami Warning Center (PTWC) and submit a report to ITIC recommending the most expedient means of communication. This report should be submitted to ITIC by 1 June 1978.

ITIC will review these recommendations and suggest improvements in the TWS communication plan. Implementation of these recommended improvements will be the responsibility of the Member States.

The Group is of the opinion that the goal of the TWS should be to verify the existence of a tsunami within one hour after the time of generation. As a first step, ITIC and PTWC will prepare a report defining the system of TWS gauges needed to achieve the goal. The recommended network of gauges, based on historical data and communication links, will be published in the ITIC newsletter by September 1978. Member States are requested to consider establishment of the recommended gauges as appropriate and to report to ITSU-VII on their progress.

The Group requests each Member State to provide ITIC with a description of existing gauging equipment utilized at each tsunami gauge site, as well as any planned improvements. This information should be submitted by 1 June 1978.

10. *Proposals for research on tsunamis*

The Director of ITIC and delegates of Member States reported and commented on overall objectives of research that may be of value to the understanding of the tsunami phenomenon and to improvements of tsunami warning systems. The Group emphasized the need for continuous research on tsunami. The delegate from the United States emphasized the need for each Member State to delineate tsunami hazards in their coastal areas, and brought to the attention of the Group a report by Dr. D.C. Cox of the University of Hawaii as an example of such studies. Copies of this report will be provided to all ITSU members by the United States.

11. Proposals for a tsunami educational programme

The session, with the assistance of an ad hoc group set up by the Chairman, identified three groups with whom an educational programme on tsunamis must be concerned. One group is the scientific community, i.e. those researchers concerned with the technical aspects of tsunamis. Many in this group may never be directly involved in an actual tsunami event but all are necessary for the development of appropriate input to the Tsunami Warning System. Their needs for educational material are fairly well defined - catalogues of historical events, observed data, bibliographies of current research, etc.

The next group has as its membership the co-ordinators and operators of the actual Tsunami Warning System. These may be civil and/or military authorities who have the responsibility for carrying out those actions required to save lives in the event of an actual tsunami. The needs for educational material here are less well defined and on a broader level than that for the scientific community. These may include internal training programmes on effective evacuation procedures, relief centres, etc., as well as the need to distribute educational materials in the form of brochures, slide presentations, films, etc. to the last group, the general public - or at least that portion at risk in an actual tsunami event.

The educational requirements for the general public are of a completely different character than those for the first two groups. Reduced to bare essentials, the first group must know WHEN (based on WHY) something is happening, the second group must know WHAT must be done and the third group must know HOW to carry out these actions. This implies more of a sociological and psychological problem than a technological one, and this area of education appears relatively open for further development. The needs of this group are also most heavily oriented towards individual Member States and even localities. The response of the general community to risk will be most divergent, depending on local custom, religious practices, relationship to a central authority from whom an evacuation order may come, etc.

To summarize this view, these three identifiable groups have markedly different educational needs, some of which may not have been adequately dealt with in the past.

Based on an analysis of recommendation ITSU-V.13, it appears that the educational needs of the scientific community may be reasonably well met. The needs of the administrative community are being met to some extent, but there does not appear to be any co-ordinated effort to systematically exchange information and experiences between the appropriate authorities of the Member States. Finally, the educational needs of the general public have not been addressed adequately.

In view of the weakness of the general public educational programme, the group emphasized that this element of the Commission's tsunami programme should receive special attention immediately. The public education programme should be directed towards: coastal residents, their local officials, school teachers, mass media people, policy makers and should include: straight lectures, group dynamics, live-in seminars, audio-visual aids, (slides with tape recordings,

movies, stills - cartoons) drawings, pictures to be displayed in public places and on television, radio announcements, brochures and pamphlets.

Funding of these activities are primarily the responsibility of each Member State. Support should also be provided by the IOC through its regular funds, Trust Fund and its new Voluntary Assistance Programme (IOC/VAP). The Group therefore decided that the Programme and Budget Forecast for 1981-1982 (see Annex VI), should include as a high priority item the preparation and publication of educational material. It was noted that the 1979-1980 Regular Budget does not have adequate funds for tsunami education for the general public. Thus, other funds should be sought for this purpose, perhaps through the Trust Fund.

The impact that a public education programme will have is not fully understood. One method to address this problem would be to undertake one pilot educational programme within each country and Member States are urged to do so. A report of these activities should be disseminated to other Member States via the ITIC and an evaluation presented at the next session of ITSU.

In response to the request of the Commission (res. X-19), the group invited Mr. W. Miñoza (Philippines) to be the TEMA Co-ordinator for ITSU to the Working Committee for Training, Education and Mutual Assistance in the marine sciences (TEMA). Mr. Miñoza accepted this responsibility.

The Group adopted recommendation ITSU-VI.2 (Annex II).

The Group further requests the Director of ITIC to arrange the preparation and distribution of:

1. *A catalogue of emergency evacuation plans prepared by each Member States, and*

2. *An inventory of public educational material.*

The delegate of the USSR made a tsunami film, produced in the USSR, available to ITIC for copying and provision to Member States, on request.

12. *Other matters*

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13. *Date and place of the seventh session of the ICG/ITSU*

The delegate of Chile invited the Group to hold its seventh session in his country. The delegate of the USSR stated that the USSR will not send a delegation to Chile.

After due consideration, the delegate of Canada invited the Group to accept the invitation made by the delegate of Chile. The matter was moved by Canada and seconded by the Philippines.

The Group, excluding the USSR, accepted the invitation.

14. *Adoption of the Summary Report and recommendations*

The Group adopted the Summary Report and its Annexes I, II and VI.

15. *Closure of the session*

The session closed at 17.00, on Friday, 24 February 1978. It was followed by a cruise aboard RV "Atyimba" to Corregidor Island, on Saturday, 25 February 1978.

RECOMMENDATIONS ADOPTED BY THE INTERNATIONAL CO-ORDINATION GROUP FOR THE TSUNAMI WARNING SYSTEM IN THE PACIFIC AT ITS SIXTH SESSION

RECOMMENDATION ITSU-VI.1

PROPOSED PROGRAMME AND BUDGET FORECAST 1981/82

The International Co-ordination Group for ITSU,

Recommends that the IOC, when preparing its Programme and Budget Forecast for 1981/82, take into account the budget proposals made by the Group, and the priorities the Group established within those proposals (Annex VI of the Summary Report)

RECOMMENDATION ITSU-VI.2

EDUCATIONAL MATERIAL

The International Co-ordination Group for ITSU,

Having reviewed the Tsunami educational programme being conducted within the Commission, particularly under the auspices of ITIC,

Considers the present public education element of this programme to be inadequate for the prevention of life and property;

Invites Member States to undertake the preparation and dissemination of tsunami educational material for the general public and to provide copies of such materials to ITIC;

Requests the Secretariat to investigate means of obtaining additional financial support for the preparation of tsunami educational material during the period 1978 through 1980.

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Left to Right: Dr. Eddie Bernard and Mr. Bertrand Thompson, USA; Dr. Aprilani Soegiarto, Indonesia; Dr. Gregorio Y. Zara, Pacific Science Association; and Dr. George Pararas-Carayannis, ITIC.

IGG/ITSU VI Delegates during a Group outing in Manila. Left to Right: Dr. Rajendra Singh, Fiji; Captain Romeo E. Valera, Philippines; and Dr. Hideo Watanabe, Japan.

Dr. Eddie Bernard, Director of the Pacific Tsunami Warning Center (PTWC), and Mr. Sydney Wigen, Canadian delegate, explain tsunami prediction techniques to some of the girls of the Philippine Secretariat who assisted logistically with the meeting.

Left to Right: Cdr. Thanom Charoenlaph, Thailand; Mr. Pedro Humberto Rizzo, Ecuador; Dr. Vadim Popov, USSR; Mr. G. Dohl~r, Chairman ICG/ITSU; Captain R. Valera, Philippines; and Dr. Yuri Oljunin, USSR.

Mr. G. Dohler, Chairman of ICG/ITSU addressing the delegates of the VI Session in the Philippines. From left to right: Dr. George Pararas-Carayannis, Director ITIC; Mr. Gerry Dohler, Chairman ICG/ITSU; and Dr. Gunter Giermann, IOC Deputy Secretary. Seen also is Miss Nanette Escudero, a member of the Philippine Secretariat that contributed to the success of the session.

Father Victor Padillo, Director Manila Observatory and Dr, G. Pararas-Carayannis having an informal discussion during a recess of the meetings in Manila.

NEWS EVENTS

Grant Awarded for Disaster Research at Bath University

The Leverhulme Trust Fund has awarded a grant to the Centre for Development Studies, University of Bath, England. A three-year research program will be undertaken by Mr. James Lewis, Senior Research Fellow at the Centre, which is under the direction of Dr. Leslie Palmier.

Mr. Lewis has made a study of natural disaster since 1970. So far he has concentrated on analyzing their causes and planning ways of lessening their impact. This second stage of his work is aimed at assessing the causes in vulnerable locations that will contribute to disaster when it occurs. With detailed knowledge of these causes, precautionary planning strategies, already worked out in general, will become specifically possible. Moreover, it may be possible to remove or reduce some of the contributory causes themselves, and as a result, to save lives and reduce losses.

The essential constituents of disaster are extreme natural phenomena such as earthquakes, hurricanes or volcanic eruptions and people. Disasters usually occur when the one meets the other. It follows therefore, considers Mr. Lewis, that disasters have as much to do with the social and economic development of populations as with the natural phenomena themselves. This is the reason why third-world countries are so vulnerable to natural disaster, the risk from which is continuing and ever present. Mr. Lewis aims to commence his programme by analyzing actual losses in disaster situations as they occur.

When the research programme is completed it will be possible to decide what the main factors are which make some places more vulnerable than others, what precautionary strategy should be followed and what additional resources, if any, will be required to reduce the disaster problem by taking steps in long-range planning, community planning and building construction, the dissemination of warnings and associated advice, contingency planning and in the pre-planning of relief supplies of emergency shelter, food and medicines.

The results of the research programme will be published from time to time and conveyed to intergovernmental, governmental and voluntary organizations engaged in pre- and post-disaster activity, as well as to other researchers and through direct advice.

The Centre for Development Studies, located in the University's School of Humanities and Social Sciences, was launched in 1975 in order to support and stimulate research in Development Studies by its members. Their interests, focused on the Third World, include in addition to disaster research, the control of bureaucratic corruption, development administration, export income instabilities, settler economies, state and class, human resources development, and rural development evaluation.

Further information may be obtained from Dr. Leslie Palmier or Mr. James Lewis, University of Bath, Claverton Down, Bath BA2 7AY, England.

Earthquake Forecasting Packs an Economic Jolt

The following article appeared under this heading in the "Honolulu Star-Bulletin" on April 20, 1977:

Scientists are warning that their ability to predict an earthquake may some day have disastrous economic consequences.

Eugene Haas, a behavioral scientist, told a Senate subcommittee yesterday that homeowners in a metropolitan area where a quake was predicted would be unable to purchase earthquake insurance.

He said property tax revenus would decline, construction would stop and government services would be slowed.

Haas urged the panel to make it possible for homeowners to purchase insurance once a quake is predicted for their area.

Charles Thiel, environmental director at the National Science Foundation, told the committee the problems caused by the prediction "could be as disruptive as the quake itself."

Despite the warning, a California official said there is no evidence that disruption in the local economy followed discovery of the "Palmdale Bulge" seismic movement in his state.

But Karl V. Steinbrugge, chairman of the California Seismic Safety Commission, said earthquake predictions requiring mass evacuations would be expensive.

Several witnesses testifying before the subcommittee supported an increase in federal spending for earthquake research. The Carter administration is proposing spending about $53.6 million on such work in fiscal 1978, compared with about $20.7 million this year.

Mr. Pedro Rizzo of INOCAR, visits ITIC and PTWC

Mr. Pedro Rizzo of the Oceanographic Institute of Ecuador, and delegate to the ITSU-VI Meeting, visited ITIC and the Pacific Tsunami Warning Center (PTWC), on his return trip to Ecuador. In addition, Mr. Rizzo visited with the U.S. National Weather Service's Forecast Office and the U.S. National Satellite Service in Honolulu. His visit resulted in a better understanding of the Tsunami Warning System, and emphasized the need for establishing a better communication procedure between the PTWC and the Oceanographic Institute of Ecuador (INOCAR).

Upon his return to Ecuador, Mr. Rizzo will investigate the different communication problems which exist and will report to ITIC on alternative means of local communication that can be established in mainland Ecuador and the Gallapagos islands that will permit PTWC to send press releases, and tsunami watch and warning information to Ecuador.

Dr. A. V. Rykov Visits the Pacific Tsunami Warning Center

Dr. Antoli V. Rykov, a seismologist from the Institute of Physics of the Earth in Moscow, visited PTWC from January 9 to February 1, 1978 as a part of the US-USSR Scientific Exchange Program on Integration of Tsunami Warning Systems. The purpose of his visit was to complete the installation of a special seismometer network to be used in the joint US-USSR tsunami/ seismic experiment.

The joint tsunami/seismic experiment consists of placing US and USSR very long period seismometers at Yuzhno-Sakhalinsk, USSR and Honolulu, Hawaii, USA. These instruments are designed to detect very long period seismic waves generated by large earthquakes. It is believed that these waves may be diagnostic of the tsunami potential of an earthquake. Additional uses of data from long period instruments include: Observations of earth tides, observations of free oscillations of the earth, retrieval of earthquake source mechanisms, and other solid earth geophysical studies.

In September 1717 Don Miller of the University of California at San Diego installed the US long period seismometer at PTWC and Yuzhno-Sakhalinsk. Dr. A.V. Rykov installed his instruments at Yuzhno-Sakhalinsk in June 1975 and at PTWC in January 1978. The experiment will be conducted for at least one year.

In addition to installing his seismometers at PTWC, Dr. Rykov presented a seminar at the Joint Institute of Marine and Atmospheric Research (JIMAR); visited the International Tsunami Information Center (ITIC); worked out preliminary plans to analyze the seismic data with Dr. Bernard of PTWC; toured Oahu; and, enjoyed Oahu's beaches.

Director of the National Geograpical & Solar-Terrestrial Data Center Visits ITIC

Dr. Allan H. Shapley, Director of the National Geophysical & Solar-Terrestrial Data Center, Environmental Data Services, visited briefly ITIC in March and discussed with George Pararas-Carayannis and Norman Ridgway, Tsunami Data Exchange and cooperation between WDC-A Tsunami and ITIC.

UNESCO - IOC - ITSU

Indonesia becomes a Member of ICG/ITSU

During the Sixth Session of the International Co-ordination Group for Tsunami Warning System in the Pacific (ICG/ITSU), Dr. Aprilani Soegiarto,

representing the Government of Indonesia applied for membership of ICG/ITSU, making Indonesia the sixteenth Member-State of the Group. Dr. Soegiarto also informed the Group of the establishment of a Tsunami Working Group in Indonesia, following the tsunami disaster of August 19, 1977, which struck the south coast of the islands of Lombok and Sumbawa in the Lesser Sunda Islands of Indonesia. As a result of this disaster almost 150 people have died or are missing, more than 1,000 people suffered, and losses to houses, boats and fishing gears amounted up to one million dollars.

Fiji - New Member of ICG/ITSU

In a recent letter to the Secretary of the Intergovernmental Oceanographic Co~ mission, the Secretary for Foreign Affairs of Fiji, Mr. J. Kotobalavu, applied on behalf of the Government of Fiji for membership in the International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). The Government of Fiji nominated its Director of Mineral Development as Fiji's national representative to ICG/ITSU. Thus, Fiji becomes the 17th State to become a Member of ICG/ITSU since the Group's formation in 1965.

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Norman M. Ridgway Begins Term as Associate Director, ITIC

Mr. Norman M. Ridgway of the New Zealand Oceanographic Institute, arrived in Honolulu in early January of this year to assume his duties as the new Associate Director of ITIC. The post is supported presently by the Government of New Zealand. Mr. Ridgway is succeeding at this post Mr. Syd Wigen who returned to Canada upon the expiration of his term.

Mr. Ridgway's capabilities cover a broad spectrum in oceanography and marine environmental work. He has published many papers and reports in physical oceanography and has been a Member of the Tsunami Advisory Panel of New Zealand. Because of his experience and knowledge Mr. Ridgway is now making a very effective and productive contribution in the administration of ITIC.

Olwen and Norman Ridgway, during a recent reception honoring them upon their arrival to Honolulu.

Director of ITIC Conducts Liaison Visits to Hong Kong, Thailand and Singapore

Following the meetings of the Sixth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) in the Philippines, the Director of ITIC, Dr. George Pararas-Carayannis visited Hong Kong, Thailand and Singapore, for the purpose of co-ordinating matters pertaining to the International Tsunami Warning System. The following is an extract from his trip report:

"Following the meetings in Manila, I proceeded to Hong Kong where I met with the Associate Director of the Hong Kong Royal Observatory, Dr. P. C. Chin and members of the staff. I expressed to Dr. Chin our appreciation for the contributions of the Royal Observatory to the Pacific Tsunami Warning Service, and discussed with members of the Observatory staff, details of communications between the Royal Observatory and the Pacific Tsunami Warning Center (PTWC). I was informed that the Hong Kong Royal Observatory plans to install a total of five stations in the Hong Kong area, two of which will be on relatively open coasts, and therefore, may be good for monitoring tsunami activity in the South China Sea. Two stations in particular, the Waglan Island and the High Island stations appear to be particularly suitable as tsunami tide stations. Royal Observatory staff will inform ITIC, at a later time, of the installation of these gauges. Dr. Chin and the Observatory staff expressed the desire to be included in all communications on tsunami related matters.

In Thailand, I visited the offices of the National Research Council of Thailand, and met with Miss Prapasri Thanasugan, Chief, Division of Research Projects and Cooperations, and with Mrs. Boonthorn Dhamcharee, Deputy Secretary General for Natural Science. I did not have the opportunity to meet with Capt. Thavon Pongpiput, Chief, Oceanographic Division of the Hydrographic Department, but in Manila I had extensive discussions with Commander Thanom Charoenlaph of the Hydrographic Department, who was the Thai delegate to the ITSU meeting. Thailand does not have an active tsunami program, and at present there is no serious concern for the tsunami hazard in the Gulf of Thailand. However, the Navy operates a number of tidal stations, and UNDP has established two seismic stations. Furthermore, responsibility for tsunami warning activity for studies in Thailand is divided under several government organizations and institutes, such as the Hydrographic Department, the Meteorological Department, and the Harbour Department. The National Research Council, and specifically, the Thailand National Marine Science Committee, has overall responsibility for co-ordinating all tsunami-related activities. Interest was expressed in participating more fully in TWS and ITSU activities, not so much for tsunami protection of the coastal areas of Thailand, as much as to learn of disaster preparedness procedures and to maintain scientific interaction with other groups. I was requested to maintain close contact with the National Research Council of Thailand and particularly, with the National Marine Science Committee, and to include them in our ITIC Newsletter distribution and all future communications. Commander Thanom Charoenlaph will submit to ITIC in the near future a listing of stations in the Gulf of Thailand and the Andamanc Sea, one or more of which could be integrated into the TWS along with any of the existing seismic stations. AFTN communications to Thailand are adequate at the present time, and a communication plan with Thailand could be easily established.

In Singapore, I met with Dr. K. Rajendram, Director of the Meteorological Service of Singapore with whom I discussed the Tsunami Warning System, ITIC, and the results of the ITSU meeting in Manila. He expressed great interest in the work of the Group, and he would like to maintain close communication with ITSU, ITIC, and IOC; however, he emphasized that historically, Singapore has not been affected by tsunamis, and that active participation into the Tsunami Warning System on an operational basis, may not be necessary. Dr. Rajendram mentioned that tide stations in Singapore are operated by the Port Authority and not the Meteorological Service; therefore, I would have to contact the Port Authority to coordinate inclusion of a Singapore tide station into the TWS network."

ITIC Action Items from the Sixth ITSU Meeting

A number of guidelines were provided to ITIC for the operation of the Center at the Sixth meeting of the International Coordination Group, for the Tsunami Warning System in the Pacific (ICG/ITSU), in Manila, Philippines. The following specific action items for ITIC were identified:

1. Future activity reports on ITIC should be distributed to member states two months in advance of any future meeting.

2. ITIC was asked to prepare a guide for tsunami damage and survey procedures, a report to be completed by August 1978.

3. Member States will review communication facilities between TWS gauges and Pacific Tsunami Warning Center, and submit a report to ITIC recommending the most expedient means of communication by June 1978. ITIC will review these recommendations and suggest improvements of the TWS communication plan.

4. ITIC will review the need for a Regional Tsunami Warning Systems in the Pacific as expressed specifically by Ecuador, Fiji and Indonesia.

5. ITIC, in cooperation with PTWC, will prepare a report defining the system of TWS gauges needed for the TWS to verify the existence of a tsunami within one hour after the time of generation.

6. ITIC will arrange for the preparation and distribution of: a) a catalog of emergency evacuation plans prepared by each member state, and b) an inventory of public educational materials.

7. ITIC will work on the tsunami educational needs identified by ITSU, to the extent of available resources, and will solicit from member states all available educational materials.

8. The Director of ITIC will work closely with the ITSU Chairman, the IOC Secretary, and the ITSU Coordinator to the WC/TEMA, on training needs of Member States.

9. ITIC will continue to be the focal point and will provide liaison to Member States within the ITSU Group.

EDITORIALS AND LETTERS

Review of Communication and Tide Gauge Facilities

One of the proposals for further technical improvements of the Tsunami Warning System in the Pacific (TWS) that was made at the VI Session of ICG/ITSU, in Manila in February, was that a review by each Member-State of its communication facilities should be made with recommendations for improvements submitted to ITIC by 1 June 1978.

Another proposal dealt with each Member State providing ITIC with a description of existing gauging equipment utilized at each tsunami gauge site, again the information to be submitted to ITIC by 1 June 1978.

I like to remind national contacts of Member-States of this short deadline and to request them kindly to coordinate in their countries the expeditious preparation and submission to ITIC of these reports. I am hopeful that these reports will result in definite improvements of the International Tsunami Warning System and I wish to thank everyone for their valued cooperation and contribution.

George Pararas-Carayannis
Director, ITIC

NATIONAL AND AREA REPORTS

Hydraulic Modelling of Tsunami Behaviour at Kyoto University, Japan

Hydraulic modelling of the transformation characteristics of long-period waves such as tsunamis and storm surges, has been carried out at the Ujigawa Hydraulic Laboratory, Disaster Prevention Research Institute, Kyoto University, Kyoto, Japan. These characteristics have been investigated in relation to their effect on breakwaters to be constructed at a harbour entrance. A basic experiment on the method of control of the transformation of tsunamis in an estuary has been actively carried out. Also, in order to establish a criterion in the design of wall-typed gates for the prevention of a tsunami disaster, the characteristics of the shock pressure of a tsunami surge on a wall were investigated, both with a model experiment and by applying the Cross theory of the shock pressure of surges. The spatial distribution of tsunami heights resulting from the reflection and shoaling of tsunamis intruding into the Osaka bay has recently been considered.

The Disaster Prevention Research Institute, to which the Ujigawa Hydraulic Laboratory is attached, was established and affiliated with Kyoto University in March, 1951 in order to carry out scientific and engineering researches on various problems concerning the prevention of natural disasters. It now has 16 research sections and 13 attached facilities.

A brochure describing the research activities of the Ujigawa Hydraulic Laboratory was published in English, in April 1976. Copies of publications, when available, may be obtained either free or at a nominal charge from the Director of the Laboratory, Professor Hirotake Imamoto.

New Director for INOCAR

Capitan de Fragata Fernando Alfaro Echeverria became in January of this year the Director of the Oceanographic Institute of the Navy of Ecuador (INOCAR), succeeding Capitan de Corbeta Pedro Cabezas Gonzalez, who was recently reassigned to a new post.

New Director for the Pacific Region, U.S. National Weather Service

Dr. Ray Jensen was appointed in January of this year as the new Director of the Pacific Region, U.S. National Weather Service, succeeding Mr. Charles Woffinden, who retired recently.

USSR Tsunami Commission Conference

Professor S.L. Soloviev, Chairman, Council on Seismology and Earthquake Engineering, USSR Academy of Sciences, recently supplied ITIC with a brief review of the Tsunami Commission Conference, in USSR.

The Tsunami Commission Conference of the Joint Council on Seismology and Earthquake Engineering. USSR Academy of Sciences, was held in Moscow on June 16-17, 1977. Fifty participants representing 20 national organizations attended the Conference and the following papers were presented.

Theoretical Studies

A new mathematical model for the investigation of tsunami generation and spreading processes is suggested in a paper by A.A. Dorfmann. Equations of approximate

non-linear dispersion theory for long-period gravitational waves excited by sea bottom displacements and spreading in a basin of variable depth are derived. The equations obtained contain non-linear and dispersion terms in the first undisappearing approximation and represent a generalization of the Bussinesk's equations.

L.E. Novikova and L.A. Ostrovsky's paper concerns the problem of tsunami excitation in the ocean during the breaking of a fault in a strip area of the sea bottom, the arbitrary velocity of breaking being given. Analyses are done within the framework of long wave linear theory, which conventionally corresponds with tsunami waves in the open ocean. Two models are discussed, one with a rectilinear profile of bottom displacement transversal to the fault and the and the other with a variable sine profile.

Methods of tsunami calculation which account for the effects of waves nonuniformity, diffraction and amplitude are discussed by E.N. Pelinovsky, I.A. Soustova and V.E. Friedman in their paper. They derive transient diffraction equations summarizing the known Leontovich-Fox parabolical equation for paraxial rays and investigate the diffraction of waves at different profiles of depth..

The joint and separate influence of dispersional and non-linear effects on tsunami deformation at the waves propagation from deepwater into the coastal zone is analyzed by L.B. Cherkesov and B.F. Ivanov. The Korteweg-de-Vrie equations that describe waves in an ocean of variable depth are taken as the initial equations and are transformed to a system of quasilinear equations of hyperbolic type and solved by the characteristics method. The wave profile and water particle velocity field in deep water are adopted at the initial time moment.

The joint effect of dispersion and non-linearity upon wave amplitude is small but the wave profile changes considerably.

Research done mainly by N.S. Plink (Leningrad Hydrometeorological Institute) over recent years was summarized by V.G. Buchteev. According to a contract with the Sakhalin Complex Research Institute N.S. Plink made calculations connected with the Kuril Islands and Kamchatka coast tsunami zonation. The water elevation, as a generalized striped tsunami source elongated along the Pacific coast of the USSR, was given in the semisinusoid form. The one-dimensional calculations were carried out mainly within the ray tubes, but in areas with complicated relief two-dimensional calculations were made. A condition of total reflection was put on the 10m depth contour and a condition of free wave run out was put on the oceanic edge of tubes; the mathematical expression of the latter condition however needs to be more precise.

A preliminary scheme of tsunamizonation along the 10m depth contour was compiled. The wave height near the coast compared with the tsunami source increases from 2 to 7 times and for 56°/° of the coast it changes from 2 to 3 times. Dispersed and concentrated energy reflection on the shelf slope and edge transforms a solitary wave into a wave train. Standard calculations according to Green's formula overestimate tsunami height near the coast.

Numerical modelling of the 1964 Niigata tsunami made it possible to retrace the tsunami transformation regularities in a two-dimensional area that is limited

by the coast and to make conclusions about the relief of the initial water elevation.

Tsunami Warning Systems

The prospects of material base strengthening of the Far Eastern tsunami warning service were discussed by K.P. Rizhkov, A.M. Agafonnikov, A.A. Poplavsky and A.M. Smolin, B.M. Jaque, G.P. Orshansky, B.I. Belokon. The automation of seismic information and the creation in the open ocean of a tsunami registration system using bottom cable and buoy stations were considered as the tasks of primary importance. V.M. Jaque's information on the successful operation of a distant tide gauge on Shumshu Island, near Severo-Kurilsk, in the autumn and winter of 1976/1977 was of considerable interest. Yu.R. Orshansky suggested a programme for effective tsunami forecasting of such problematic secondary effects as forerunning waves of level lowering generated by water viscosity, electromagnetic irradiation, water ionization, etc. The programme was discussed in a lively way.

International Cooperation

S.S. Voit reported on the International Tsunami Symposium held in March 1977 in Ensenada, Mexico. V.P. Vadkovsky suggested that the international exchange of actual tsunami data is insufficient. Z.K. Grigorash informed the Commission about plans to compile a new bibliography of papers on tsunami.

The Commission reviewed the papers that were delivered and approved the project of creating an automated tsunami warning system. They recommended the compilation of a new bibliography on tsunami; the publication of a new edition of collected papers on tsunami and a start to preparations for the International Symposium on Tsunami that is to take place in Australia in 1979. Three new members were elected: V.I. Belokon, B.N. Pelinovsky and Friedmann.

ABSTRACTS AND RESUMES

Effects of a Major Earthquake Near Bougainville, 20 July 1975

I. B. Everingham, B. Gaull and V. Dent
Australian Bureau of Mineral Resources
Journal of Australian Geology and Geophysics
Volume 2, (1977), pp 305-310

Abstract

On 20 July 1975 a major earthquake (MS7.9) shook the northern islands of the Solomon Islands chain. Damage amounting to at least $300,000 (Australia) occurred in the southern Bougainville/Shortland Islands region, where earthquake intensities were estimated to be MMVII-VIII. A tsunami with maximum amplitude of about two metres followed the earthquake and caused further damage. The earthquake caused landsliding, liquefaction, subsidence, slumping of roads and wharfs, and damage to villages, small government and mission buildings, and to the mining installations at Panguna.

Aftershock epicentres were in a roughly elliptical area of 12,500 square kilometres off the southwestern coast of Bougainville. Focal depths were in the range 30-70 km. A fault-plane solution and the pattern of aftershocks indicate that the principal earthquake was associated with underthrusting of the Solomon Sea crust beneath Bougainville, in a northeasterly direction and with a dip of about 37°.

The faulting associated with the 20 July 1975 earthquake appears to be the extension of faulting associated with a 1974 earthquake series.

An aseismic zone, centred at 6°S, 154°E, exists immediately northwest of the 1975 earthquake fault zone, between zones where major earthquakes have occurred since 1970. It is considered to be a likely place for a major earthquake in the future.

Local Tsunamis and Possible Local Tsunamis in Hawaii

Doak C. Cox and Joseph Morgan
Environmental Center
Hawaii Institute of Geophysics
University of Hawaii, Honolulu
and
Department of Geography
University of Hawaii, Honolulu

HIG-77-14

Abstract

A list of reported tsunami events in Hawaii has been compiled from catalogs of tsunamis, other geophysical literature, and local contemporary sources. Of the events listed, 48 had been reported as tsunamis of local or uncertain origin. Intensive search of contemporary sources of information indicated that no unusual waves were actually observed on Hawaiian coasts on the dates of 17 of the reported events, and that the unusual waves of six of the dates were certainly of meteorological origin and on one of the dates were certainly a distant tsunami. There may have been two local tsunamis on each of two dates, however.

Reliable evidence could be found for only 21 possible local tsunamis, including two on one of the dates and two on another. Local tsunami generation is certain for six, probable for two, questionable for five, and very doubtful for eight.

Runup heights of possible tsunamis have been compiled for all coastal sites at which there were reports of measurements or of effects from which the heights might be estimated. The highest runups were reported for the certain local tsunamis of 2 April 1868 and 29 November 1975. Considerable coastal subsidence accompanied the generation of both tsunamis; their maximum runup heights would have exceeded 50 feet if measured from pre-subsidence sea level.

Twelve of the possible local tsunamis were associated with earthquakes, including those of April 1868 and November 1975 that were associated with the two largest

earthquakes in Hawaiian history. Those two and three other certain tsunamis were probably generated by tectonic displacements of the submarine slopes. There may have been a second independently generated tsunami of tectonic origin associated with the 1868 earthquake. The significance of the earthquake associations of the rest is doubtful, with one exception (a possible tsunami generated by a landslide triggered by an earthquake).

Eight of the possible local tsunamis were associated with volcanic activity. However, direct connection is probable in the case of only one tsunami observed on shore; that one was associated with a lava flow entering the ocean and may have resulted from submarine slumping of the lava.

Tectonic disturbances or submarine landsliding were possible sources of the local tsunamis whose generating mechanisms are uncertain.

Six of the possible local tsunamis were generated along the southeast coast of Hawaii. These include three of the certain local tsunamis, among them the major tsunamis of 1868 and 1975. Along the west coast of Hawaii, one local tsunami was certainly generated and three others possibly so; along the northeast coast of Hawaii, possibly three; along the north coasts of Maui, Molokai, or Oahu, possibly four; and along the coast of Lanai or the south coasts of Maui, Molokai, or Oahu, possibly three.

Height-frequency distributions indicate that a local tsunami with a maximum run-up height of about 40 feet may be expected, on the average, every hundred years, the likelihood being greatest on the northeast coast of Hawaii.

Research and Development of Permanent Ocean-Bottom Seismograph Observation System off the Pacific Coast of Central Honshu, Japan

Akira Suwa, Norio Yamakawa, Tatsuto Iinuma
Seismology and Volcanology Division
Meteorological Research Institute
Japan Meteorological Agency

Presented at 9th Joint Meeting of US-Japan Panel on Wind and Seismic Effects. May 24-27, 1977, Tokyo, Japan.

Abstract

80 to 90% of all the earthquakes in the world occur in the sea area. However, there is not yet a single permanent ocean-bottom seismograph; this a great weak point in seismic activity monitoring and earthquake prediction. The development of a permanent ocean-bottom seismograph observation system off the Pacific coast of Tokai District, central Honshu, which the Seismology and Volcanology Division Meteorological Research Institute has been engaged in, is one of the major items included in the 3rd Five-Year Plan of the National Program of Earthquake Prediction Research in Japan (1974-1978).

The observation system is a combination of submarine and land equipment. The submarine equipment consists of one terminal apparatus and several intermediate

apparatus, i.e. pressure vessels containing seismograph and tsunami-meter sensors, and signal transmitters, which are connected in series by a submarine co-axial cable. This equipment is laid one hundred and scores of kilometers off Omaezaki, Shizuoka Prefecture, at the ocean-bottom down to 3,000m below sea level. On the other hand, the land equipment consists of receiving and repeating apparatus in the shore station (Omaezaki Weather Station), and receiving and data processing apparatus at the Earthquake and Tsunami Center (Japan Meteorological Agency in Tokyo).

This development project has been progressively implemented. Trial layings of the submarine equipment have been carried out already and actual layings are planned in 1978.

On Transformation of Tsunamis in a Coastal Zone

Shigehisa Nakamura
Kyoto University, Japan

Marine Technology Society Journal
Volume 12, No. 1 (1978), pp 22-25

Abstract

In order to obtain fundamental information in establishing warning practices and effective countermeasures against tsunamis on the coast, the refraction of tsunamis in Osaka Bay and tsunami spectra were studied. Tsunami refraction was studied by numerical computation of a small amplitude wave. Refraction is an important factor in determining tsunami wave height distribution along the coast of Kii Peninsula and Shikoku. The mareograms of the tsunamis were analyzed into power spectra to find the frequency characteristics of the tsunamis and their transformation from the open ocean to the head of Osaka Bay. The results suggest that the study of tsunami transformation by the use of the refraction diagram is not easy because a tsunami is not a simple monochromatic, small amplitude plane wave. A brief remark is given for the analyses of the tsunamis as non-stationary processes.

Historical Study of Tsunamis -- An Outline

Sydney O. Wigen
Institute of Ocean Sciences
Patricia Bay
Sidney, B.C.
Canada

Pacific Marine Science Report 78-5

Abstract

This paper is intended to set forth objectives for an Historical Study of Tsunamis; to summarize the preparatory work carried out at the International

Tsunami Information Center; and to provide a procedural outline for those participating in the Study.

Tsunami Research Symposium 1974

Edited by R. A. Heath and M. M. Creswell

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and
The Royal Society of New Zealand
Box 12249
Wellington, New Zealand

Contents

Papers and abstracts of papers presented to the International Union of Geodesy and Geophysics Tsunami Committee Meeting and Symposium held in Wellington, New Zealand from 29 January to 1 February 1974.

ANNOUNCEMENTS

International Symposium on Long Waves in the Ocean - June 6-8, 1978

This Symposium (sponsored by the Department of Fisheries and the Environment, Canada, co-sponsored by the American Geophysical Union and the Waterway, Port, Coastal and Ocean Division, ASCE and endorsed by the International Union of Geodesy and Geophysics, American Meteorological Society, National Research Council, Canada and Canadian Meteorological and Oceanographic Society) is to be held in the Auditorium of the National Research Council, Sussex Drive, Ottawa.

The program sessions and keynote speakers are:

	Welcome	- A.E. Collin
	Theme	- P.H. LeBlond
1.	Tidal theory	- D.E. Cartwright
2.	Tidal observation and analysis	- Open for nomination
3.	Tsunami	- S.O. Wigen
4.	Storm surge	- T.J. Simons
5.	Continental shelf waves	- L.A. Mysak
6.	Instrumentation	- Open for nomination

The above session arrangement could be modified after assessment of the titles of proposed contributions.

Abstracts were due by March 1 and will be distributed to participants prior to the meeting.

For further information, write:

Organizing Committee
Long Wave Symposium
Marine Environment Data Service
Department of Fisheries and the Environment
Ottawa K1A 0E6, Canada

GATE Symposium on Oceanography and Surface Layer Meteorology 1978

The Symposium will be held in Keil, Federal Republic of Germany, from 16 to 20 May 1978. It is aimed at combining results of the Oceanographic and the Boundary Layer Subprogrammes of GATE, focusing on processes in the ocean and the atmosphere that are influenced by air-sea interaction.

Participation in the Symposium is open to scientists from all nations who are involved in the analysis of GATE-data.

Disaster Research at Bradford University

The Disaster Research Unit, University of Bradford was formally terminated in December 1977. However, research commenced by the Unit will be continued by Mr. K. N. Westgate who will also provide an information and advisory service.

Enquiries concerning the work of the former Disaster Research Unit and orders for publications should be addressed to:

Mr. K. N. Westgate
Project Planning Centre for Developing Countries
University of Bradford
Bradford BD7 1DP
West Yorkshire, England

14th Pacific Science Congress - August 1979

The 14th Pacific Science Congress will be held in Khabarovsk, USSR, in the latter part of August, 1979.

President of the Congress is Academician A. V. Sidorenko, Vice-President of the USSR Academy of Sciences, who is also Chairman of the Organizing Committee. General Secretary of the Organizing Committee is Dr. A. A. Aksenov. Deputy General Secretary is Dr. K. V. Malakhovsky.

IUGG Tsunami Publications

1. Proceedings of the Tsunami Meetings, Honolulu, 1961 (256 pages)
   U.S. $7.20/copy

2. Annotated Bibliography on Tsunamis, 1964 (249 pages)
   U.S. $6.20/copy

Both of these publications are still available and copies can be purchased by writing to:

Mr. G. Laclavere
Director, IUGG Publications Office
39 TER, Rue Gay-Lussac
75005 Paris, France

12th International Symposium on Mathematical Geophysics

This Symposium, sponsored by the IUGG Inter-Association on Mathemtical Geophysics, will be held in Caracas, Venezuela on August 14-24, 1978. The topics to be discussed will include:

1. Automatic Processing of Large Amounts of Data

   including problems of exploration of earth resources, data reduction in the field of prediction of natural catastrophes, and pattern recognition.

2. Inverse Problems of Geophysics

   including problems of lateral heterogeneity and solutions to difficult forward problems.

3. Models of Evolution of the Earth's Solid, Liquid and Atmospheric Regions

   including tectonic evolution, origin of the oceans and atmospheres and long term climatology.

4. Mathematical and Computational Problems in Prediction of and Risk due to Natural Catastrophes

   including problems of prediction of Earthquakes, Tornadoes, Typhoons, etc.

The Symposium is being organized by the Venezuelan Foundation for Seismic Research (FUNVISIS). Queries should be addressed to:

FUNVISIS
Apartado Postal 1892
Caracas 101
Venezuela

Seismic Summary (January 1 to Press Time)

Event No.	Event	Location	Action Taken
1978-1	Jan 14 0324 (UT) (PTWC) 6.3	Ō Shima, Japan 34.7 N 139.4 E	Press Release
1978-2	Feb 9 2135 (UT) (PTWC) 6.7	Kermadec Island 33.3 S 179.8 W	Press Release
1978-3	Feb 20 0437 (UT) (PTWC) 5.6 (ATWC) 5.7 (JMA) 6.8	N.E. Honshu Is.,Japan 38.8 N 141.6 E	Press Release
1978-4	Mar 22 0050 (UT) (JMA) 6.8	Kuril Is. 43.7 N 149.5 E	Press Release
1978-5	Mar 22 2134 (UT) (PTWC) 6.3	Kuril Is. 44.2 N 149.0 E	Press Release
1978-6	Mar 23 0031 (UT) (PTWC) 6.3 (ATWC) 6.7	Kuril Is. 44.0 N 149.0 E	Press Release
1978-7	Mar 23 0314 (UT) (PTWC) 7.2	Kuril Is. 44.5 N 146.3 E	Press Release Queried tide stations at Nemuro, Hachinohe, Shimizu, Yuzhno Kuril'sk, Marcus Is., Guam and Midway. Nemuro tsunami arrival 0405 hrs., maximum height 24 cm; Yuzno Kuril'sk arrival 0455 hrs., 25 cm
1978-8	Mar 23 1912 (UT) (PTWC) 6.5	Kuril Is. 44.3 N 149.9 E	

PTWC - Pacific Tsunami Warning Center, Honolulu

ATWC - Alaskan Tsunami Warning Center, Palmer Observatory

JMA - Japan Meteorological Agency, Tokyo